II. CLAIM AMENDMENTS

1. (Currently Amended) A method of providing protection against acoustic shock, the method comprising ~~the steps of~~:

performing a pattern analysis on an input signal in a time domain, including:

at an oversampled analysis filterbank, transforming the input signal to a plurality of band signals in a frequency domain, and

performing a feature extraction from the input signal and performing a feature extraction from the plurality of band signals, to identify a parameter space corresponding to a signal space of the input signal;

applying a rule-based decision to the parameter space to detect an acoustic shock event~~; and~~including:

determining a shock flag based on each of the input signal and band signal feature extractions; and

removing the acoustic shock event based on the shock flags.

2. (Cancelled)

3. (Original) A method as claimed in claim 1 wherein the step of removing the acoustic shock event includes the step of:

performing gain control.

4. (Original) A method as claimed in claim 3 wherein the gain control is performed by a state machine.

5. (Original) A method as claimed in claim 1 further comprising the step of:

performing calibration to keep an output signal provided to a user at a specific level.

6. (Currently Amended) A method as claimed in claim 1 further comprising ~~the step of~~:

implementing on-line data collection of the acoustic shock event ~~from the input signal~~.

7. (Currently Amended) A method of providing protection against acoustic shock, the method comprising the steps of:

performing a weighted overlap-add (WOLA) analysis on an input signal in a time domain to transform the input signal to a plurality of band signals in a frequency domain;

performing feature extraction on the input signal and performing feature extraction on the band signals ~~provided by the WOLA analysis~~;

detecting an acoustic shock event based on the input signal and band signal feature extractions, including:

determining a shock flag based on each of the input signal and band signal feature extractions,

performing gain control based on the acoustic shock detection including the shock flags and the features extracted from the input signal and band signals~~;~~, the band signals being modified by the gain control;

applying a calibrated gain to meet a predetermined safe output level; and

performing a WOLA synthesis on the modified band signals to ~~synthesize~~ provide an output signal ~~where the band signals are by the gain control~~.

8. (Original) A method as claimed in claim 7 wherein the step of detecting an acoustic shock event uses a rule-based decision.

9. (Original) A method as claimed in claim 7 further comprising the step of:

delaying the input signal to the WOLA analysis to allow time to obtain fast broadband features to aid in the interpretation of the WOLA analysis results.

10. (Currently Amended) A system for providing protection against acoustic shock, the ~~device~~ system comprising:

an analysis module for performing a pattern analysis on an input signal in a time domain, including;

an oversampled analysis filterbank for transforming the input signal to a plurality of band signals in a frequency domain; and

performing a feature extraction from the input signal and performing a feature extraction from the plurality of the band signals, to identify a parameter space corresponding to a signal space of the input signal;

a detection module for applying a rule-based decision to the parameter space to detect an acoustic shock event, including:; ~~and~~

a module for determining a shock flag based on each of the input signal and band signal feature extractions; and

a removal module for removing the acoustic shock event based on the shock flags.

11. (Cancelled)

12. (Original) A system as claimed in claim 10 wherein the removal module performs gain control.

13. (Original) A system as claimed in claim 12 wherein the detection module includes a state machine for performing the gain control.

14. (Original) A system as claimed in claim 10 further comprising a removable module for logging the acoustic shock events.

15. (Original) A system as claimed in claim 10 further comprising a calibration module for performing calibration to keep an output signal provided to a user at a specific level.

16. (Currently Amended) A system as claimed in claim 10 further comprising a logging module for implementing on-line data collection of the acoustic shock event.

17. (Currently Amended) A system as claimed in claim 10 ~~further comprising a module for performing~~ wherein the oversampled analysis filterbank comprises a weighted overlap-add analysis filterbank for transforming the input signal into a plurality of oversampled sub-band signals in a sub-band domain, and wherein the system comprises a weighted overlap-add synthesis filterbank ~~to implement processing in sub-bands~~ for providing an output signal.

18. (Currently Amended) A system for providing protection against acoustic shock, the ~~device~~ system comprising:

a weighted overlap add (WOLA) analysis module for transforming an input signal in a time domain to a plurality of band signals in a frequency domain;

a feature extraction module for performing feature extraction on the input signal and for performing feature extraction on the band signals;

a detection module for detecting an acoustic shock event based on the input signal and band signal feature extractions, including~~;~~:

determing a shock flag based on each of the input signal and band signal feature extractions;

a gain control module for performing gain control based on the acoustic shock detection including the shock flags and the features extracted from the input signal and band signals, the band signals being modified by the gain control;

a calibration module for applying a calibrated gain to meet a predetermined safe level; and

a WOLA synthesis module for synthesizing the modified band signals to provide an output signal.

19. (Original) A system as claimed in claim 18 wherein the detecting module detects the acoustic shock event using a rule-based decision.

20. (Original) A system as claimed in claim 18 further comprising a delay module for delaying the input signal to the WOLA analysis to allow time to obtain fast broadband features to aid in the interpretation of the WOLA analysis results.

21. (Currently Amended) A method of providing protection against an acoustic shock, the method comprising ~~the steps of~~:

at a weighted overlap-add (WOLA) analysis filterbank, transforming an input signal in a time domain into a plurality of oversampled sub-band signals in a frequency domain, including implementing block processing to the input signal;

adaptively processing the sub-band signals to remove an acoustic shock event, including processing each sub-band signal to remove a periodic acoustic shock event; and

combining the processed sub-band signals to generate ~~the~~ an output signal.

22. (Cancelled)

23. (Currently Amended) A method as claimed in claim ~~22~~ 21 wherein ~~the step of~~ processing ~~the~~ each sub-band ~~signals~~ signal includes ~~the steps of~~:

delaying the sub-band signal,

adaptively filtering the delayed sub-band signal, and

adding the sub-band signal and the result of the filtering step.

24. (Original) A method as claimed in claim 23 further comprising the step of:

adjusting the filter.

25. (Currently Amended) A system for providing protection against an acoustic shock, the ~~device~~ system comprising:

a weighted overlap-add (WOLA) analysis module for implementing block processing to an input signal in a time domain to ~~transforming~~ transform ~~an~~ the input signal into a plurality of oversampled sub-band signals in a frequency domain;

a processing module for adaptively processing the sub-band signals to remove an acoustic shock event, including a plurality of sub-band periodic acoustic shock cancellation modules, each processing a corresponding sub-band signal; and

a WOLA synthesis module for synthesizing the processed sub-band signals to provide an output signal.

26. (Cancelled)

27. (Currently Amended) A system as claimed in claim ~~26~~ 25 wherein the sub-band periodic acoustic shock cancellation module includes:

a delay module for delaying the sub-band signal,

an adaptive filter for adaptively filtering the delayed sub-band signal, and

a summer for adding the sub-band signal and the output of the filter.

28. (Original) A system as claimed in claim 27 further comprising a module for adjusting the filter.

29. (Original) A method as claimed in claim 9, further comprising the step of adjusting the delay time of the delaying step.

30. (Original) A method as claimed in claim 29, wherein the delay time is reduced to zero so that the inherent group delay of the WOLA analysis is used to provide the required delay

31. (Original) A system as claimed in claim 20, further comprising means for adjusting the delay time of the delaying module.

32. (Original) A system as claimed in claim 31, wherein the delay time is reduced to zero so that the inherent group delay of the WOLA analysis is used to provide the required delay.

33. (Currently Amended) A method as claimed in claim 7, ~~where~~wherein the shock flags comprises:

a time domain shock flag based on the feature extraction from the input signal and,

a narrowband shock flag based on the feature extraction from the band signal, wherein ~~the step of detecting an acoustic shock event includes the steps of:~~

~~determining a time domain shock flag based on the feature extraction from the input signal; and~~

~~determining a narrowband shock flag based on the feature extraction from the band signal,~~

the step of performing gain control includes at least one of the following steps of:

calculating a broadband gain based on the feature extraction from the input signal and the time domain shock flag;

calculating a narrowband gain based on the feature extraction from the band signal and the narrowband shock flag;

calculating a gain weighting ratio based on the time domain shock flag, the narrowband shock flag and the extracted features of the input signal and band signals; and

calculating a gain for the gain control based on the broadband gain, narrowband gain, the weighting ratio and the narrowband shock flag.

34. (Original) A method as claimed in claim 33, further comprising the step of:

staring a broadband counter when the shock is detected in the time domain.

35. (Original) A method as claims in claim 34, wherein the broadband counter is used for calculating the broadband gain and the narrowband gain.

36. (New) A method of providing protection against acoustic shock, the method comprising:

performing a weighted overlap-add (WOLA) analysis on an input signal in a time domain to transform the input signal to a plurality of band signal in a frequency domain;

delaying the input signal to the WOLA analysis to allow time to obtain fast broadband features to aid in the interpretation of the WOLA analysis results;

performing feature extraction on the input signal and performing feature extraction on the band signals;

detecting an acoustic shock event based on the input signal and band signal feature extractions;

performing gain control based on the shock detection and the features extracted from the input signal and band signals, the band signals being modified by the gain control;

applying a calibrated gain to meet a predetermined safe output level; and

performing a WOLA synthesis on the modified band signals to provide an output signal.

37. (New) A method as claimed in claim 36, further comprising adjusting the delay time of the delaying step.

38. (New) A method as claimed in claim 37, wherein the delay time is reduced to zero so that the inherent group delay of the WOLA analysis is used to provide the required delay.

39. (New) A system for providing protection against acoustic shock, the device comprising:

a weighted overlap add (WOLA) analysis module for transforming an input signal in a time domain to a plurality of band signals in a frequency domain;

a delay module for delaying the input signal to the WOLA analysis to allow time to obtain fast broadband features to aid in the interpretation of the WOLA analysis results;

a feature extraction module for performing feature extraction on the input signal and for performing feature extraction on the band signals;

a detection module for detecting an acoustic shock event based on the inputs signal and the band signal feature extractions;

a gain control module for performing gain control based on the shock detection and the features extracted from the input signal and band signals, the band signals being modified by the gain control;

a calibration module for applying a calibrated gain to meet a predetermined safe level; and

a WOLA synthesis module for synthesizing the modified band signals to provide an output signal.

40. (New) A system as claimed in claim 39, further comprising means for adjusting the delay time of the delaying module.

41. (New) A system as claimed in claim 40, wherein the delay time is reduced to zero so that the inherent group delay of the WOLA analysis is used to provide the required delay.